

What are the most risky parts of perfusion?



Agenda: Risk of damage?

Side effects:

- Coagulation
 - Immune system
 - Fluid overload
- etc...

Accidents, leading to:

- Embolism
 - Ischemia
 - Arrest
- - etc...

Accidents; -causes

- Patient related
- Technical
- Human error



Potential technical problems

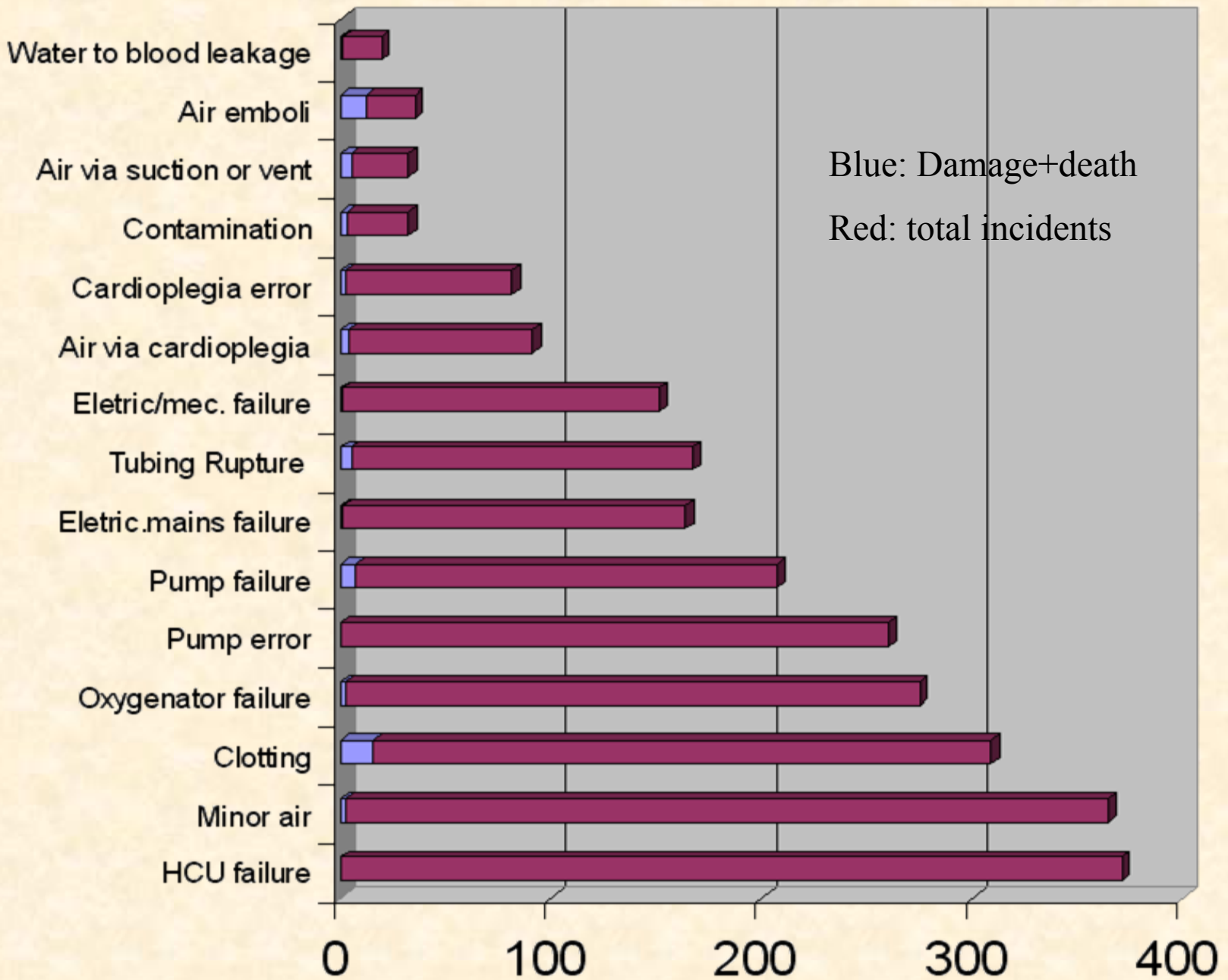
- Components of circuit
 - Utensils
 - Hardware
- HLM: alarms etc.
- HCU

- Power supply
- Gas supply

ERROR	CAUSE
Oxygenator failure	Leakage; blood to air -- water to blood Poor oxygenating High pressure Failure of O ₂ -supply
Pump failure	Mechanical breakdown Electrical: fuses, power failure False feed-back alarms
Leakage	High pressure – no alarm Tubes non secured Damaged tube or component

Air	Empty reservoir Vacuum i oxygenator V-A shunt A-filter O ₂ outlet on oxygenator obstructed Tubing rupture Over-pressurerized reservoir Suction or MUF reversed
Clotting	Insufficient heparinization Suction of blood after Protamin
Accidental Low-flow	Mis-calibrated flow/RPM Confused tubing size Insufficient occlusion Vacuum+low occl+soft pump-tube Soft alarm

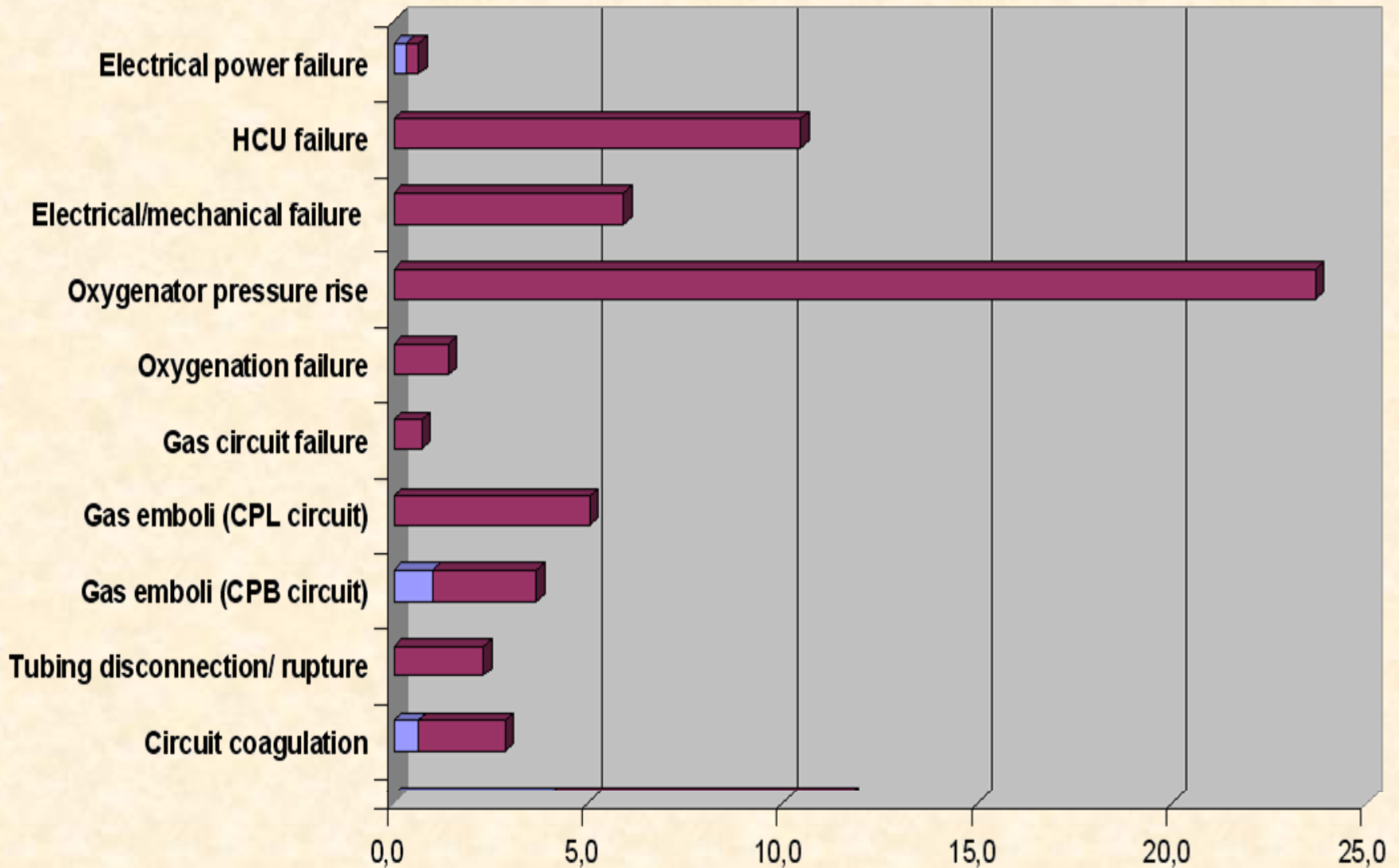
Country	Us	Aus	Us	Se	Fr	Dk
Author	Kurusz	Jenkins	Mejak	Sven/App	Charrière	Dansect
Year	82-85	94-95	96-98	90-04	2005	05-08
N	574.000	27.000	671.000	13.000	32.000	15.000
Incidents*	100	286	72	178	51	68
D+D*	10	8	7 (1)		7 (3)	4,7
*of 10.000						
Oxygen*			4,1	104	8,3	15,4
Air*			1,6	71	6,8	3,6
Clotting*			4,4	48	2,2	1,8
Mech/pump*			3,9	91	5,9	15,4



Svenmarker/Appelblad 2004

	<u>90-04</u>	<u>04 (1/2Y)</u>
• Oxygenator failure	104	20
• Mechanical failure	91	59
• Gas delivery failure	75	00
• Line separation	75	00
• Gas embolism	71	20
• Hypo-perfusion	57	00
• Coagulation	48	00
• Electrical failure	43	39
• Reservoir failure	19	20
• <u>Contamination</u>	7	20
TOTAL:	590	178

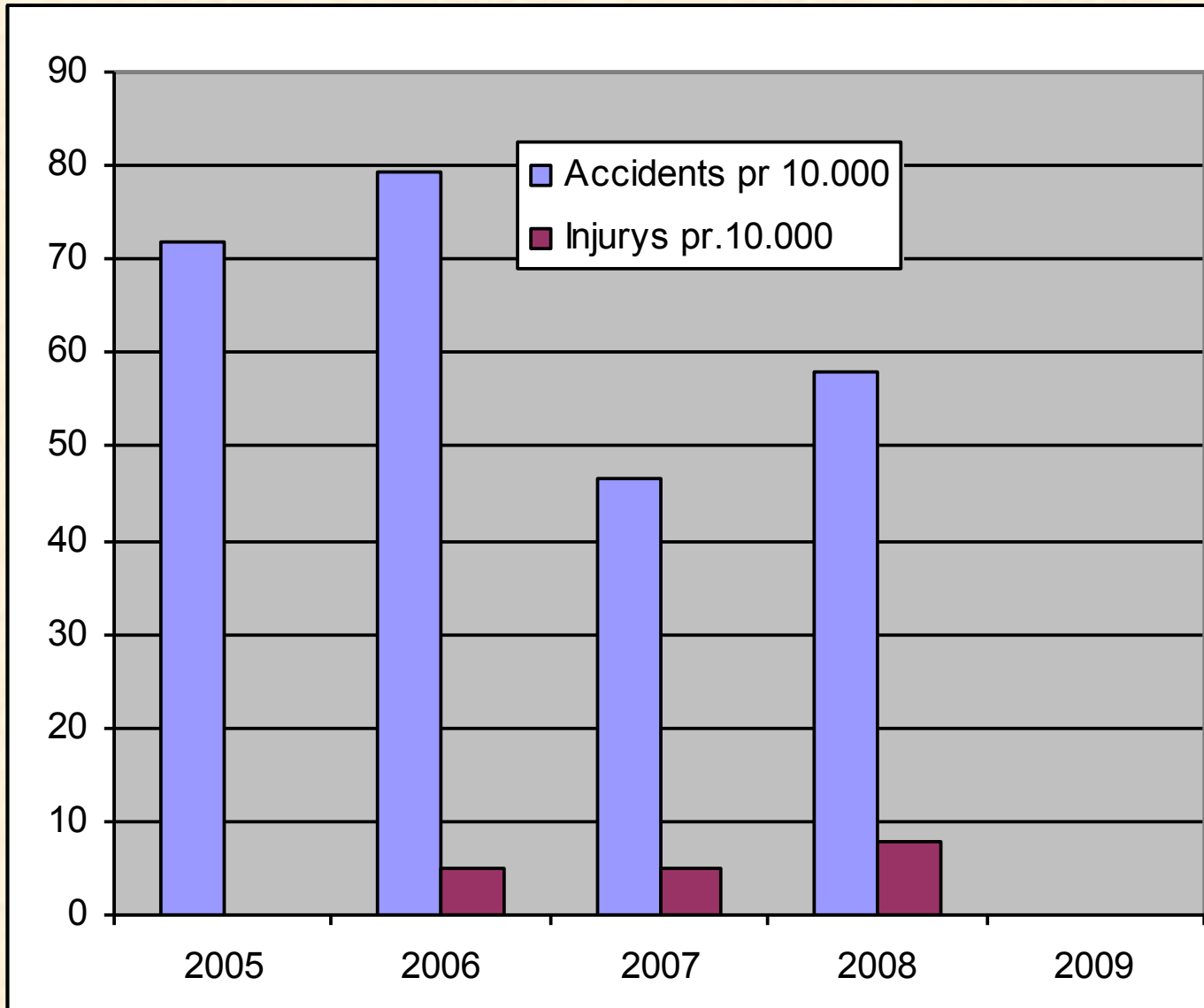
Charrière: Of 10.000: Incidents 51. D+D: 2



Accidents in Denmark

	2005	2006	2007	2008	
Incidents	29	31	19	22	
Pr. 10.000	96	79	47	58	
Damage / Death	0	2	2	3	
% Human Error	45%	58%	47%	41%	

Accidents per. 10.000 Cases



Confirmed damage

Tubing rupture
Cannulation error
Contamination of circuit
Tubing disconnection
Clotting in oxygenator
Clotting in reservoir



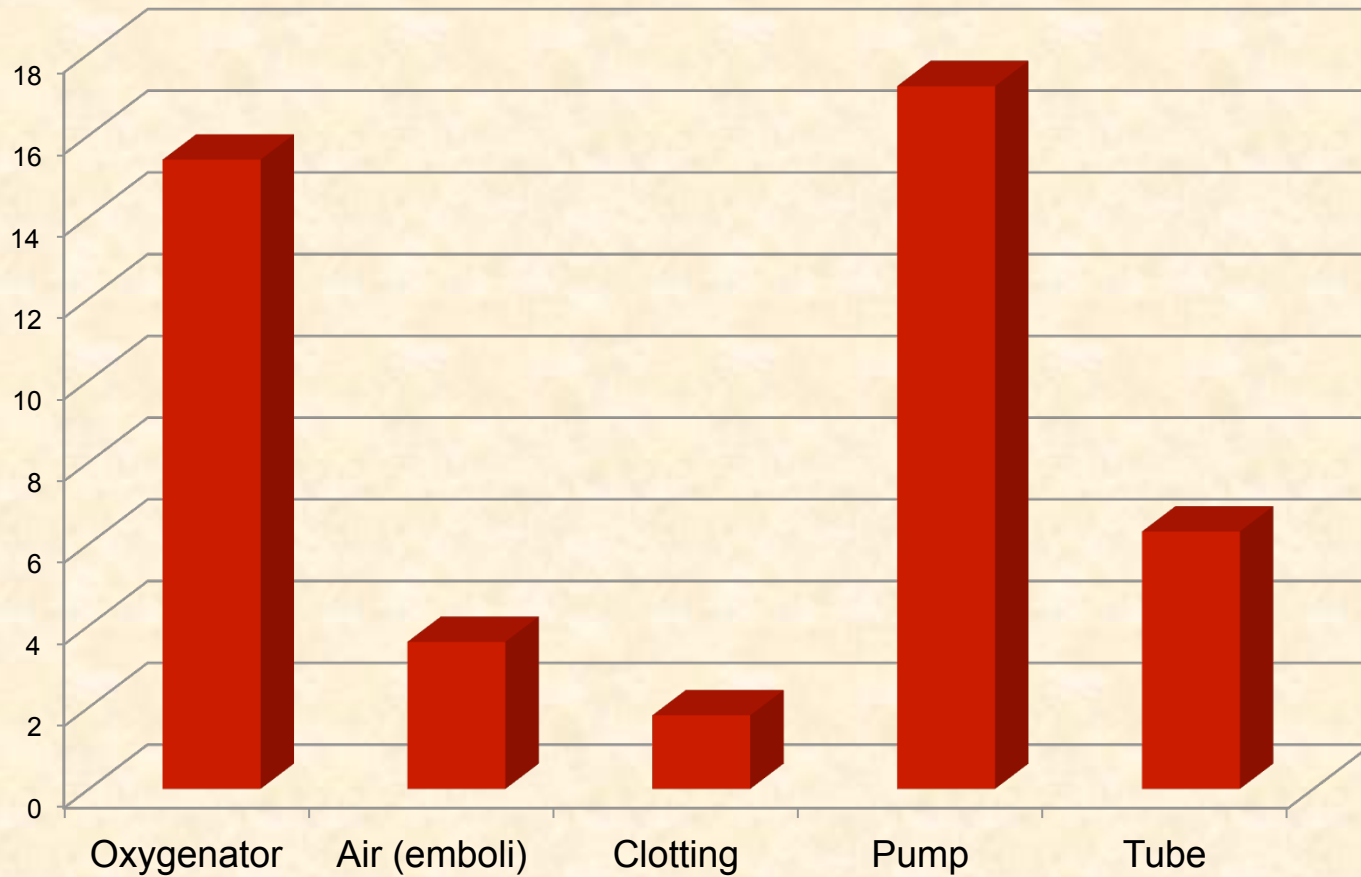
Gaseous emboli -reaching pt	1
Gaseous emboli - not reaching pt	3
Gaseous emboli - via vent	0
Gaseous emboli - via cardioplegia	0
Tubing rupture	5
A-filter leakage	2
Reservoir leakage	0
Tubing disconnection	4
Pump stop - mains failure	2
Pump stop - mechanical failure	5
Pump stop - electrical failure	7
Pump stop - alarm failure	3
Cardioplegia failure	9
Clotting in oxygenator	1
Clotting in reservoir	2
Oxygenator high pressure	11
Oxygenator failure (O2)	1
Oxygenator failure (CO2)	2
Oxygen supply failure	7

Oxygenator leakage	3
Heat Exchanger leakage	0
HCU failure	5
Pump stop due to airlock	3
Pump stop - operating error	2
Erroneous flow - setting error	2
Erroneous flow - open AV shunt	3
Accidental desangvination	2
Accidental crash cooling/warming	2
A-cannulae disconnection	2
Cannulation error	1
V-catheter disconnection	0
High pressure in venous reservoir	1
Prime error	2
Cerebral perfusion error	1
Cell Saver error	0
contamination of circuit	1
Other	6

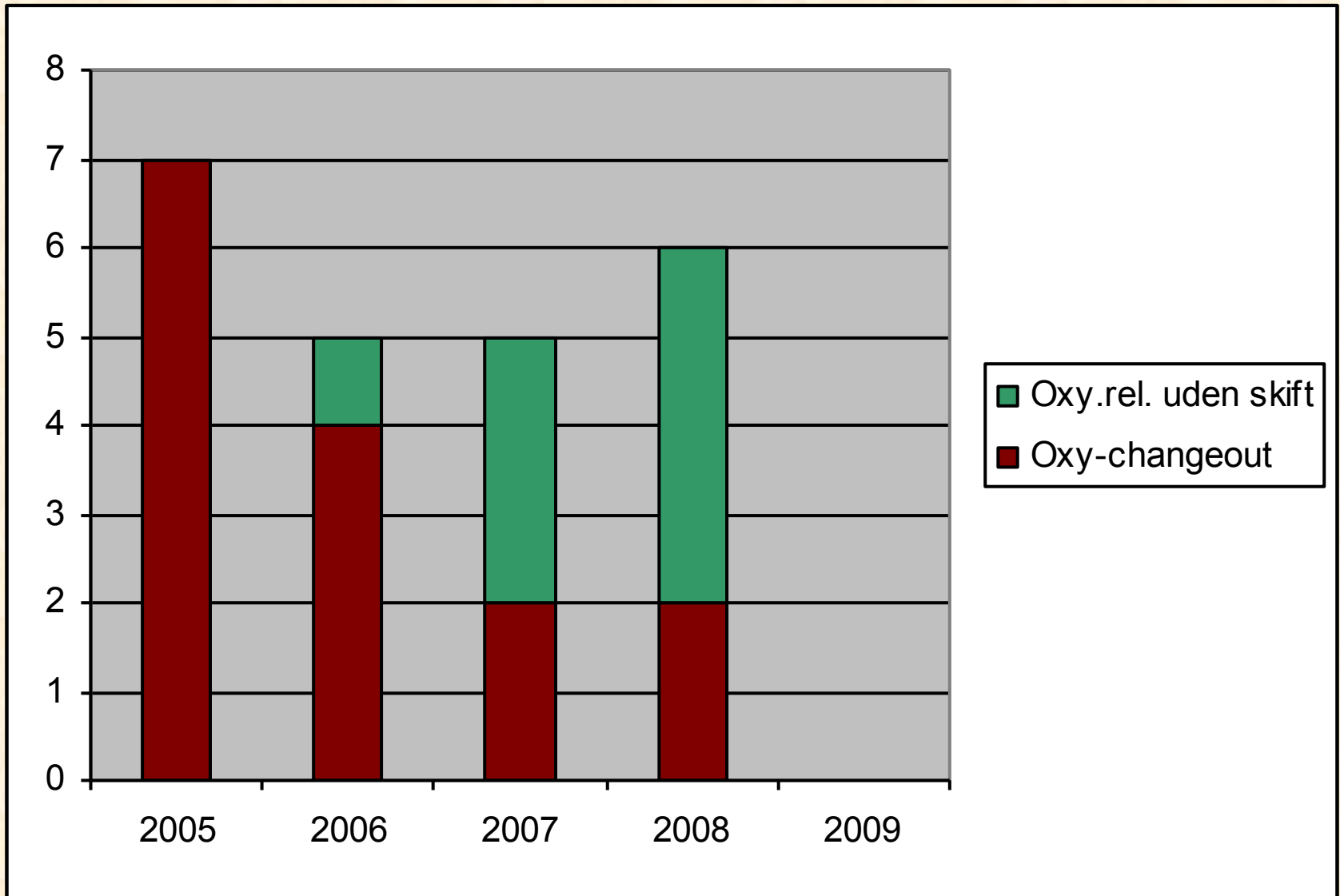
Top scores

Oxygenator high pressure	11
Cardioplegia failure	9
Pump stop - electrical failure	7
Oxygen supply failure	7
Other	6
Tubing rupture	5
Pump stop - mechanical failure	5
HCU failure	5
Tubing disconnection	4
Gaseous emboli - not reaching pt	3
Pump stop - alarm failure	3
Oxygenator leakage	3
Pump stop due to airlock	3
Erroneous flow - open AV shunt	3

Groups of incidents



Oxygenator problems



Human Errors – top 16

Cardioplegia failure	6
Oxygen supply failure	4
Pump stop due to airlock	3
Gaseous emboli - not reaching pt	2
Tubing disconnection	2
Clotting in reservoir	2
HCU failure	2
Pump stop - operating error	2
Erroneous flow - setting error	2
Erroneous flow - open AV shunt	2
Accidental desangvination	2
Prime error	2
Tubing rupture	1
Clotting in oxygenator	1
Accidental crash cooling/warming	1
High pressure in venous reservoir	1

Mistakes:

Monitor-error

Flow-error

Gas-error

Misunderstandings

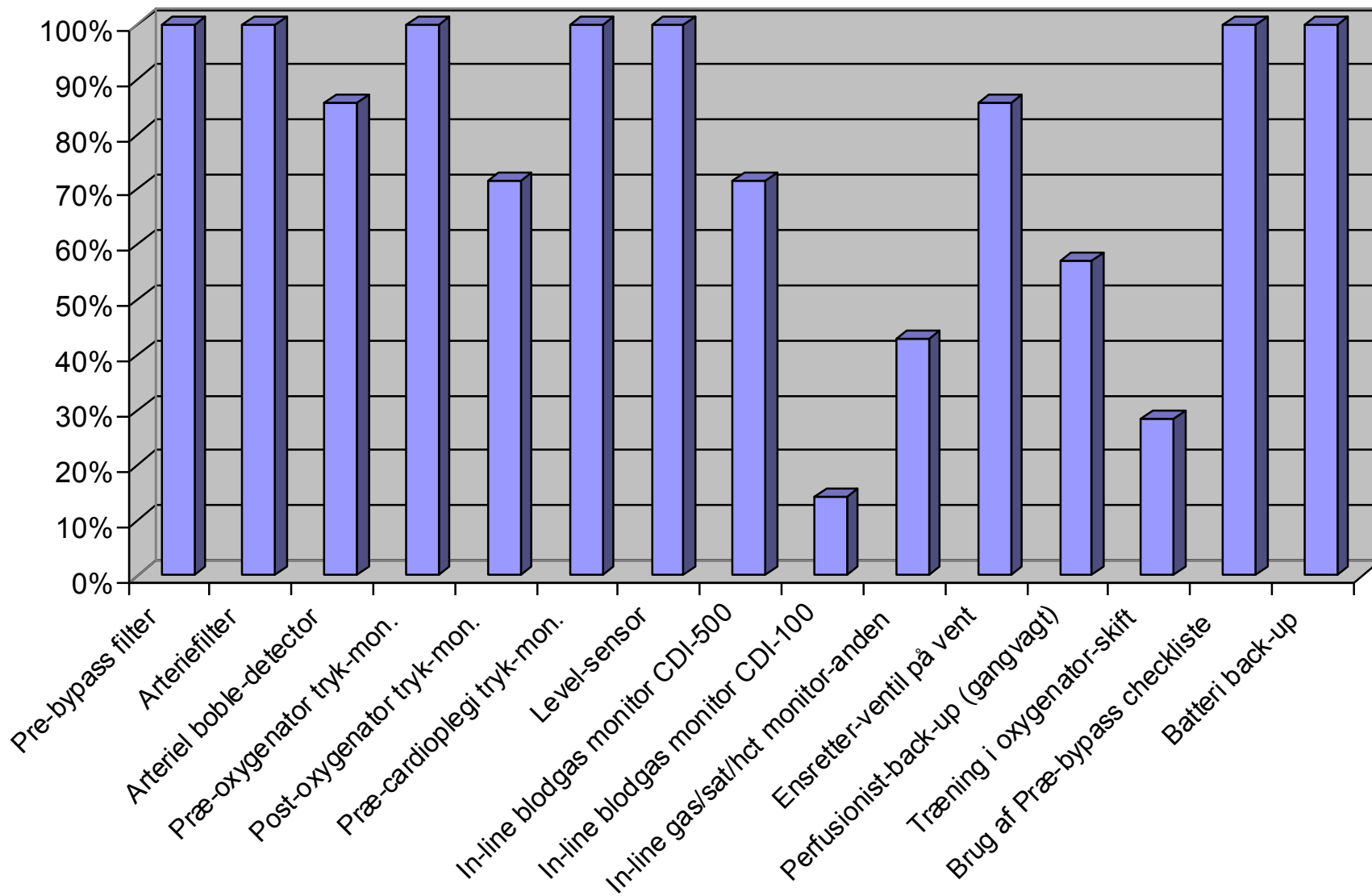
And MUCH more



Preventing accidents

- Being cautious
- Procedures
- Maintenance
- A plan, and prepared stuff
- Training
- Safety devices

Safety devices and precautions



Conclusion: Most risky..

Technical/medical:

- Oxygenator
- Pump
- Tube / components leakage

Human errors:

- Cardioplegia
- Oxygenation
- Air, - V or A
- Flow

